IN THE UNITED STATES DISTRICT COURT FOR THE
NORTHERN DISTRICT OF OKLAHOMA

W. A. DREW EDMONDSON, in his capacity as ATTORNEY GENERAL OF THE STATE OF OKLAHOMA and OKLAHOMA SECRETARY OF THE ENVIRONMENT C. MILES TOLBERT, in his capacity as the TRUSTEE FOR NATURAL RESOURCES FOR THE STATE OF OKLAHOMA, Plaintiff,	)
vs.	) 4:05-CV-00329-TCK-SAJ
TYSON FOODS, INC., et al, Defendants.	)

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VOLUME I OF THE VIDEOTAPED DEPOSITION OF GLENN JOHNSON, PhD, produced as a witness on behalf of the Plaintiff in the above styled and numbered cause, taken on the 24th day of February, 2009, in the City of Tulsa, County of Tulsa, State of Oklahoma, before me, Lisa A. Steinmeyer, a Certified Shorthand Reporter, duly certified under and by virtue of the laws of the State of Oklahoma.

EXHIBIT "B"

this system, which is -- the degree to which -- well, first of all, total concentration and second, the degree with which how chemicals redistribute themselves in the environment according to their affinity for being bound to particulates or being in a dissolved phase. 11:08AM

Q This is your muddy, salty water?

A Yeah, it's the shorthand that I used within the report, but, yes.

Q Anything else; any other key opinions? 11:08AM

A I think these are the six that I pulled out because I thought they were the key six, so --

Q Fair enough, and, again, I'm not trying to limit you.

A Right. 11:08AM

Q I'm just trying to get a good understanding of what your testimony is going to be. Dr. Johnson, did you perform any of your own evaluation of phosphorus or bacteria contamination in the watershed, and when I say watershed or I say IRW, 11:09AM what I'm meaning is the Illinois River watershed at issue in this case.

A Okay. Understood. Well, I indicated to you that I looked at the raw phosphorus concentrations by way of making maps. So in that respect, yes. 11:09AM

Q That was the report -- the samples and analyses collected by the State of Oklahoma in this case?

A No. This would have been data -- oh, yes. To the extent that the data produced by Dr. Olsen falls 11:09AM in that category, yes.

Q Okay. I wasn't clear. What I'm asking you, did you perform any of your field investigations in this case?

A Oh, no. 11:09AM

Q Why not?

A I was asked to look at the PCA that Dr. Olsen did based on the existing data.

Q Okay. So is it fair for me to understand that your primary role is to critique the opinion of Dr. 11:09AM Olsen on his PCA analysis?

A To understand what he did and evaluate the degree to which it did or did not support his opinions and conclusions.

Q For the PCA analysis? 11:10AM

A For the PCA analysis.

Q Did you evaluate any of the other opinions in Dr. Olsen's report?

A Peripherally but in the context of the degree to which it informed on the PCA. 11:10AM

Q Okay, but you're not offering any opinions on non-PCA opinions in Dr. Olsen's report?

MR. GEORGE: Object to form.

A No. Again, to the extent that I call on a discussion in another part of his report that 11:10AM informs me on the PCA.

Q Okay. Are you offering any opinions as to what the major sources of phosphorus are in the Illinois River watershed?

A No. 11:10AM

Q How about sources of bacteria, same question?

A No.

Q Are you offering any opinions to critique any of the other State experts in this case?

A No. 11:11AM

Q Which of the State experts' reports have you reviewed?

A I reviewed Fisher's report, obviously nowhere in the detail I looked at Dr. Olsen's report. I'm trying to think if there are others. I believe 11:11AM there's either a letter -- I don't know if it's an expert report, but a letter from Harwood is an appendix in Dr. Olsen's report, which I have seen but I wouldn't say approached anything near a critical review. Those are the only ones I can 11:12AM

think of.

Q Okay, and are you offering any opinions concerning Dr. Fisher's report?

A No, not specifically. I believe the poultry house density map, which I used as a base layer, if 11:12AM I read Dr. Olsen's report correctly, was actually work that was done by Fisher. So I guess secondarily, yes.

Q We'll get to that in a little while. Did you review Dr. Engel's report? 11:12AM

A I don't believe I did.

Q Do you know that Dr. Engel did a modeling analysis in this case to identify sources?

MR. GEORGE: Object to form. Answer, if you can. 11:12AM

A I knew there was modeling being done on the plaintiff's side. I wasn't sure if I could have told you it was Engel that did it.

Q Okay. Did you review Dr. Teaf's report?

A No, I have not. 11:13AM

Q Did you review any information involving the -- what I would call an analysis of the amount of bacteria that is in waste streams within the Illinois River watershed?

A Not that I recall. 11:13AM

A Yes.
Q -- was that a source identification project?
A Again, that was the objective.
Q Were you able to identify sources in that particular study? 11:20AM
A Some of the patterns we saw were related to source. I'm pretty sure some of the patterns we saw were related to geochemical process.
Q Okay. Did you use a multivariate analysis on that case? 11:20AM
A Yes, we did.
Q Anything else; can you think of any of other projects where you focused on inorganic constituents in your source of contamination analysis?
A When you asked the question a couple of times ago, you -- at that point you started limiting it to PhD and not -- 11:21AM
Q Yeah. I think it's post PhD. That's my intent. Thank you.
A There was another -- there was similar to the Stan Riggs, Albemarle one. There may be others. I'd be glad -- if you want to spend the time, I can go back through my CV, but it's up to you. I may be able to add a couple to the list if you want. 11:21AM
Q Is it fair to characterize your experience as 11:21AM

primarily related to organic contaminants?
A Yes, post PhD, that's -- did you say organic?
Q Yes.
A Yes. Chlorinated organic even more so.
Q Okay. Have you ever worked on -- I'm going to say a case -- I'm going to mean an investigation, a source investigation -- involving agricultural pollution other than this case? 11:21AM
MR. ELROD: Object to form.
A Not that I recall. 11:22AM
Q How about nutrient pollution?
MR. GEORGE: Object to form.
Q Have you worked on a case other than this case that involved nutrients as the contaminants of concern? 11:22AM
A Not that I recall.
Q How about same question with regard to bacteria; prior to this case, have you worked on a case involving bacteria as a contaminant of concern?
A No. 11:22AM
Q And I assume by your earlier answers, the answer would be no, that you've never worked on a case involving poultry waste?
MR. GEORGE: Object to form.
A No, I've not. 11:22AM

Q Or any other animal waste pollution?
A In our dioxin fingerprinting work, one of the patterns that we identified was consistent with the dioxin-furan congener pattern that's observed in sewage sludge, and so the answer to that would be yes. 11:23AM
Q And that would be the only instance?
A That's the only one I recall.
Q Okay. Have you been involved in a source identification project where you are looking for pollutants or sources of pollutants on a watershed-wide basis? 11:23AM
A Yes.
Q Which cases are those?
A That would have been -- would not have been an inland watershed such as this, but within my CV there's reference to a couple of papers from early to mid '90s where we were looking at dioxins and furans in Newark Bay, Passaic River, Hackensack River, Arthur Kill, basically metropolitan New York. 11:23AM 11:24AM
I wouldn't say it's -- certainly in terms of scale of watershed, it was a pretty large scale.
Q Have you been involved in an inland watershed investigation similar -- like the Illinois River watershed? 11:24AM

A I've been involved in stream studies inland. The Union City is an example. Watershed -- inland watershed of this size, no.
Q Have you been to the Illinois River watershed?
A Yes. 11:24AM
Q When was that?
A Mid July of 2008.
Q Any other occasions other than last summer in July?
A Actually in the watershed, no. 11:24AM
Q Okay. When you went to the watershed, did you make any observations?
A I was there for a full day. I saw -- I'm not sure what you mean by observations but, yes, I observed a lot. 11:25AM
Q Okay, and what did you observe? Did you get like a tour of the watershed?
A I got a tour, yes.
Q Okay. What were you shown?
A We -- on the first day or first part of that day, there was me and two other scientists retained by the defendants whose names I don't recall. We were given a tour of the watershed by air, flying out of Siloam Springs. I don't recall the exact route we took, but I know that we went south and 11:25AM

A Not that I recall. I mostly focused on the PCA results to the extent that it's discussed in my expert report.
Q Did you do any evaluation of the chemical constituents of cattle waste? 01:31PM
A Again, that was part of the same two principal component runs that included the poultry litter.
Q But you didn't look at the analytical results on the cattle waste itself?
MR. GEORGE: Object to form. 01:31PM
A I believe that I probably looked at the spreadsheets that contained that data. I did not spend much time reanalyzing that data as I did with the principal components analyses.
Q Did you find that there's a different chemical 01:32PM composition between poultry and cattle waste?
MR. GEORGE: Object to form.
A To the extent it's reflected on that PCA graph, yes. They plot in different locations on the PCA graph, which indicates that at least for the 01:32PM chemicals that are accurately back calculated in that PCA, they have different chemical compositions.
Q Did you do any evaluation of the chemical constituents in human waste?
A No. I don't know that I've seen data that -- 01:32PM

that -- that shows that and, again, that was -- nor was it what I was asked to evaluate.
Q Did you do any evaluation, Dr. Johnson, about the amount of waste produced by poultry production within the IRW? 01:33PM
MR. GEORGE: Object to form, asked and answered.
MR. PAGE: My earlier question had to do with the amount of poultry, and this question has to do with the amount of poultry waste. 01:33PM
MR. GEORGE: Same objection.
A Again, no and, again, I was not asked to.
Q What about cattle waste; did you do an evaluation about the amount of cattle waste produced in the IRW? 01:33PM
A Same answer.
Q Swine?
A Same answer.
Q Human waste?
A Same answer. 01:33PM
Q Would you turn to Page 4 of your report, sir? Under 1.3, opinions --
A Uh-huh.
Q -- would you read the last sentence of that paragraph, please, under the first bullet? 01:34PM

A In addition, there are multiple other sources not considered by Olsen at all, spray irrigation, sludge application, biosolids application, nursery runoff, golf courses, wildlife, swine lagoons, septic systems, runoff from dirt roads and 01:34PM commercial fertilizer application.
Q Did you consider the chemical compositions of any of those sources in your analysis?
A I did not. I was not asked to do that. I was asked to -- 01:34PM
Q I understand you may not have been asked.
A Okay.
Q That's fine. I just wanted to ask the question.
A All right. 01:34PM
Q That's fair enough. I mean, you are only responsible for what you were asked to do. Let me ask another question. Did you do any evaluation of the amount of waste that would be generated by each of the sources you just read from in your report? 01:34PM
A No, I've not.
Q If that's the case, sir, then you don't -- you haven't done a chemical evaluation of the waste from those different sources, nor you do not know the amount of waste generated from those sources. How 01:35PM

can you then be critical of Dr. Olsen for not considering those sources?
MS. COLLINS: Object to the form.
A Well, for one, these things that I'm telling you I was not asked to do, I believe he was. He was 01:35PM asked to put together a PCA-based model that identified sources. Number two, when I redid the PCA, I came to the conclusion, based on my reanalysis, that that was driving -- the signal that was driving the two principal component model that 01:35PM he presented was related to the basic geochemical affinity of the analytes, specifically potassium, chloride, sodium, sulfate, iron and aluminum, and so the PCA story is not a story related to source, as much as it is a story related to chemical affinity. 01:36PM
Q How can you know whether or not these sources you listed would be important for consideration if you don't know either its chemical composition or the amount of that source that's generated within the IRW? 01:36PM
A Because regardless of their chemical composition, it's the affinity of the chemicals once they start partitioning in the environment that is driving this chemical system that is being analyzed here. 01:36PM

A Except to the extent to compare the PCA results to the source characterization that Dr. Olsen indicated supported his conclusions.
Q Do you know what the sources of phosphorus are in the IRW? 01:42PM
A No, I don't.
Q Do you know what the sources of bacteria, fecal bacteria are in the IRW?
A No, I don't.
Q Do you know whether or not poultry litter that's land applied is incorporated into the soil or not? 01:42PM
A I don't know if it's just laid down or whether it's tilled into the soil somehow. In terms of how it's applied, I don't know technically how that's accomplished. 01:42PM
Q Do you know how long poultry waste has been applied in the IRW?
A No.
Q Are you aware of any pasture, hay field in the IRW that has not received poultry waste? 01:43PM
MR. GEORGE: Object to form.
A The Fite property is rodeo cattle; right? It was not pasture. Was that your question, pasture or what was the second part? 01:43PM

Q Hay field.
A The only samples I've seen from a cattle field in absence of poultry has been the Fite property, which my understanding was rodeo stock. So the answer to your question would be no. 01:43PM
Q Did you do any evaluation of sources for phosphorus in the IRW at all, review any literature, for example?
A There's literature cited in my report. Was your question specific to IRW? I'm sorry? 01:44PM
Q Yes, yes. Sources of phosphorus in the IRW.
A No.
Q Did you do any evaluation of sources of phosphorus in ambient water, surface waters of the IRW? 01:44PM
A Again, this is a question I thought you asked at first, but one of the papers I cited in my report is Sharpley and Smith, and he addresses -- he addresses phosphorus in surface water sources -- phosphorus sources in surface water. Excuse me. 01:44PM
Q And why did you review that?
A If memory serves -- well, let's not go from memory. If I could turn to my report --
Q Certainly. Can you tell me where you're looking and that will help us, please? 01:45PM

A Yes. After I've -- in my report on Page 62, after I've made the point that the bottom sample trend of Olsen's SW3 scores plot is driven primarily by the concentration of total iron plus total aluminum, I point out that iron and aluminum are generally associated with sediment fraction of natural waters, and adsorption of phosphorus to suspended particulate matter is common, and that phosphate ions taken up from water in alumina clay particles -- are taken up by water -- I'm sorry -- taken up from water by alumina clay particles and freshly precipitated iron aluminum hydroxides, and I cite a source for that, and then the next sentence, as such, particle-bound phosphorus constitutes much of the phosphorus in runoff from cultivated lands, and I cite Sharpley and Smith, and in the Sharpley paper he identify -- he identifies some of these cultivated land sources of phosphorus. 01:45PM 01:45PM 01:46PM
Q So it's your opinion that most of the phosphorus that runs off from land-applied fields where poultry waste has been applied is in the particulate form? 01:46PM
MR. GEORGE: Object to form.
A I'm saying most of the total phosphorus that we measure in the water is bound to particulates. 01:46PM

Whether it is released from the source in the dissolved phase and later adsorbs onto a particle or a sediment grain, I'm not saying that I know if it was originally released as a particulate-bound phosphorus. 01:47PM
Q So it's possible that the phosphorus that's released from a poultry-applied field could have been in its dissolved phase prior to it reaching the ambient stream water?
A I can't discount that. 01:47PM
Q Do you know how many fields are cultivated fields in the IRW?
A No, I don't know that number.
Q Isn't it true that there's very few row crop in the IRW? 01:47PM
MR. GEORGE: Object to form.
A Since I don't know the number, I don't know if that's true or false.
Q Whether -- if the IRW has very few row crops, would your reliance on Mr. Sharpley's paper be somewhat doubtful? 01:47PM
MR. GEORGE: Object to form.
A I'm not sure the extent that the statement that Sharpley and Smith make about particle-bound phosphorus -- I'm not sure the extent to which that 01:48PM

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is dependent on row crops.
Q Why would you say that? If you haven't cultivated a field, if you're applying poultry waste to a non-cultivated field, isn't there less opportunity for particle affinity? 01:48PM
MR. GEORGE: Object to form.
A I'm having trouble understanding the question. You're saying --
Q Well, your statement here -- I'm sorry, Doctor, if I'm being unclear, but I'm doing my best. 01:49PM
You state here, as such -- I'm reading from your report, Page 62 -- particle-bound phosphorus constitutes much of the phosphorus from runoff from cultivated land.
A Right. 01:49PM
Q Cultivated land, that would be land that would be tilled; correct?
MR. GEORGE: Object to form.
A Yeah, but at the same time I'm not saying that cultivated land is the only source of particle-bound 01:49PM
phosphorus. The point -- this is a sentence within -- within an overall paragraph that's talking about the preferential affinity of total phosphorus to be in the particle-bound phase. Now, this sentence supports that, that it's particle bound in 01:49PM

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cultivated lands, but that doesn't mean that that affinity of total phosphorus to be bound to particulate matter is different if the particulate is coming from some source other than cultivated land. 01:49PM
Q Okay.
A Whether it's somebody's boot kicking up a little bit of mud in the bottom, whatever.
Q Did you -- have you done any evaluation of the constituents that run off of land in the IRW where 01:50PM
poultry waste has been applied?
MR. GEORGE: Object to form.
A No. I've not been asked to do -- was the question have I done --
Q Any analysis. 01:50PM
A Analysis of runoff from -- did you say cultivated or non-cultivated land or --
Q Poultry-applied lands in the IRW.
A Okay. No, not specifically.
Q Would an analysis of those, the chemical 01:50PM
contribution of that runoff be important to your PCA critique?
MR. GEORGE: Object to form.
A No, I don't think so.
Q Why not? 01:50PM

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A Because what the PCA is showing is the basic -- is the affinity of phosphorus, iron and aluminum, which means the affinity of total phosphorus to particles regardless of where they come from. 01:51PM
Q So how does that help you understand whether or not the source of phosphorus -- a source of phosphorus in the IRW is from land-applied poultry waste?
A Well, if I wanted to -- if I was asked to take 01:51PM
this and I wanted to look at -- find out what the most likely source of the particulates that have that bound phosphorus, maybe I could go through and identify each individual sample and do what you're suggesting to do, but that doesn't -- that doesn't 01:51PM
change the basic conclusion that total phosphorus prefers -- tends to be associated with the particulate phase. I don't need to take that -- I don't need to take that next step to back up a conclusion that total phosphorus tends to be 01:52PM
associated with the -- with sediments.
Q But doesn't that tend to help you understand whether or not the phosphorus that you are observing was a source from a poultry land application as opposed to another source? 01:52PM

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MR. GEORGE: Object to form.
A Perhaps if I had been asked to take -- to make that -- to take this a few extra steps to that point, then perhaps yes, perhaps no. It's difficult to comment on an analysis that I didn't do and what 01:52PM
value it might or might not have.
Q Other than this Sharpley article, did you do any other evaluation of the sources of phosphorus that are found in the surface waters of the IRW?
A Specific sources? 01:53PM
Q Yes.
A No.
Q As, you know, poultry, cattle versus wastewater treatment, for example.
A Okay. No. 01:53PM
Q I'm trying to understand, Doctor. Wouldn't that information be helpful for you in determining whether or not this is a source-driven versus a process-driven system?
MR. GEORGE: Object to form. 01:53PM
A No.
MR. GEORGE: Asked and answered.
Q Why not?
A It is a process -- first order this is a process-driven system because the first order to 01:54PM

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trends on the first two principal components are driven by iron and aluminum, which is a surrogate for particulates on one trend and sodium, potassium, the more soluble analytes, on the other trend. So it's an explanation that is much simpler. It's an explanation that doesn't call for making exceptions to a 1.3 Principal Component 1 threshold or apologizing for exceptions to the rule. It's very consistent with very simple geochemistry, and so the first order control on this system is geochemical process affinity to either sediment or in the dissolved phase. I'm not sure I answered your question, but I'm balking with --

Q I'm not sure you did either.

A I guess the original question, I don't need to go any farther than this to know that it's basic geochemistry that's driving this system. I've convinced myself of that and I hope I've convinced the people that read this report.

Q Well, let me ask you this: If there's not sufficient background quantities of phosphorus in the soils to account for the phosphorus that we're finding in the ambient waters of the IRW, to what would you attribute this phosphorus?

MR. GEORGE: Object to form. 01:55PM

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A Well, the premise is there's not sufficient background phosphorus, which you are representing to me. I don't know if that's true or not.

Q Okay. Well, did you evaluate the reference or background levels of phosphorus in the IRW? 01:55PM

A No. That's why I say I don't know whether what you are representing to me is true or not.

Q And you say that's not important to your evaluation?

MR. GEORGE: Object to form. 01:56PM

A I'm saying that it doesn't change my opinion that this is a process-driven principal components first and foremost.

Q Okay.

A Phosphorus, regardless of source or regardless whether, as you suggested perhaps, some background level, total phosphorus will -- has an affinity for the particulate phase, and that's what we're see -- that's what is driving this analysis.

Q Have you -- did you look and see whether or not there's any phosphorus that's being -- or what are the levels of phosphorus that are coming out of wastewater treatment plant effluent?

A Not a number that I recall, but that data is within the dataset. I could look at the wastewater 01:56PM

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treatment plant effluent samples and see where they were.

Q So if there was high phosphorus levels in the effluent from wastewater treatment plants, would that tend to negate your hypothesis that this is a process-driven system -- 01:57PM

MR. GEORGE: Object to form.

Q -- for the phosphorus?

A Not at all. Once the phosphorus gets out into the stream, regardless of source, whether it's wastewater treatment plant or poultry litter or what have you, the geochemical processes of adsorption and solution are relevant regardless of what the original source of phosphorus was. 01:57PM

Q Do you know whether or not poultry waste is typically applied within a few miles of where it is produced in the poultry houses? 01:57PM

MR. GEORGE: Object to form.

A No, I don't know. I don't know how far it gets transported before it's applied. 01:58PM

Q Do you know when poultry waste is most often land applied; what time of year?

A I believe spring and summer is my recollection.

Q Would you give me a definition of a watershed, 01:58PM

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please?

A My understanding of a watershed is of an area that's all within a single drainage basin, draining to a single downstream point. I -- that's not a definition that I looked up in a book before I walked in here, but that's -- I think that's a reasonable expression of my understanding. 01:59PM

Q Okay. So if you were trying to determine what land area or what waters contribute to a particular sampling point, you would try to determine which land areas drain into that area where the sampling point is being taken? 01:59PM

A Yes. That's reasonable.

Q Do you know whether or not there's a GIS program that allows one to readily identify a subwatershed to determine what area drains into a particular sampling location? 01:59PM

A Wouldn't surprise me if there was one, but I couldn't give you the name of such a software program. 02:00PM

Q Have you ever done that yourself?

A No.

Q Have you ever been called upon to identify the areas that drain into a stream where a sample is being taken, that is, draw a subwatershed? 02:00PM

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not accurately reproduce the concentrations of arsenic, copper or zinc, so the degree to which these are tracers for poultry litter is irrelevant to the PCA with only two principal components.
Q Okay. Can you go down to the bottom sentence of that paragraph where it starts we found, would you read that, please? 02:44PM
A Oh, it's not marked in highlighter? Is this the last sentence?
Q It says we found copper and zinc concentrations.
A We found copper and zinc concentrations in runoff water as high as 0.7 and 0.1 milligrams per litter, indicating a potential problem.
Q Okay. Would you agree or disagree with that statement? 02:45PM
MR. GEORGE: Object to form.
A I have no reason to disagree with it.
Q Would you go to the bottom of that column and the paragraph that begins the majority; would you read that, please? 02:45PM
A Although it is uncertain if metal runoff is a major problem with the use of animal manures, high P concentrations have been documented in runoff water from pastures fertilized with low to moderate 02:45PM

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amounts of poultry manure, causing concerns over the utilization of this valuable resource in areas of the USA where poultry production is high, and then two citations.
Q Continue. 02:46PM
A Phosphorus is normally the limiting element for eutrophication in freshwater bodies, such as rivers, lakes and reservoirs. Should I continue on to the next page?
Q Yes. 02:46PM
A The majority, 80 to 90 percent, of the P in runoff from fields fertilized with poultry litter is dissolved P, which is the form most readily available to algae.
Q Would you agree or disagree with the last statement you read there that says the majority, 80 to 90 percent, of P in runoff water from fields fertilized with poultry litter is dissolved P, which is the form most readily available to algae? 02:46PM
MR. GEORGE: Object to form. 02:46PM
A I don't know. I don't -- I have no reason to disagree with these guys.
Q Do you have any understanding of what the -- did you do any study of what the most common form of P is that is running off from poultry-litter applied 02:46PM

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fields, whether it's dissolved or total or particulate P?
MR. GEORGE: Object to form, asked and answered.
A No. 02:47PM
Q If there was particulates in poultry waste, wouldn't that prevent the loss that's in poultry waste and on land-applied fields for running off in a dissolved phase?
MR. GEORGE: Object to form. 02:47PM
A There was a key word in there that I missed. Could you please reread that, please?
COURT REPORTER: And I think I misunderstood it as well.
(Whereupon, the court reporter read back the previous question.)
Q Wouldn't that prohibit?
A I don't know the extent to which that would prohibit it or not. I don't know. That's not my area of expertise. 02:48PM
Q In your process analysis in order to confirm your analysis of the PCA, wouldn't it be important to have an understanding of what materials are running off from poultry waste in a dissolved versus a particulate phase and whether or not there's 02:48PM

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particulates in the environment to which the dissolved phase constituents could attach?
MR. GEORGE: Object to form.
A I'm not sure if it would or wouldn't because my understanding is they can partition between phases once they get into the ambient environment. 02:48PM
Q But if there isn't any particulate to partition to, wouldn't that affect your analysis?
MR. GEORGE: Object to form.
A Again, you're representing there are no particulates in the stream water and if that is true, then I suppose that's something to consider. I don't -- I doubt the streams here are void of particulate matter. 02:48PM
Q Wouldn't the relative availability of particulates in relationship to the amount of dissolved constituents or running off of poultry land-applied fields have an important place in your evaluation? 02:49PM
MR. GEORGE: Object to form. 02:49PM
A I don't know if I would characterize it as important or not.
Q Can we look to Page 94, sir, of the same article?
A Oh. I'm sorry. 02:49PM

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contamination?
A It can be, but there's no guarantee that it will.
Q Okay. So you recognize it has been used in the past to identify sources? 02:56PM
A Yes, it has.
Q Okay. Do you believe it could be effective in identifying sources in the IRW?
A I state this in my report. I don't believe it could be unless -- especially if you're interested 02:56PM in phosphorus in bacteria, I don't think it's possible without going back and getting a consistent and complete data.
Q I think I've covered this. I want to make sure. Do you know how many different sources of 02:56PM nutrients there are in the IRW?
MR. GEORGE: Object to form, asked and answered.
Q Sources in water in contamination?
A Sources of -- 02:56PM
Q Nutrients.
A No, I don't.
Q How about for metals?
MR. GEORGE: Same objection.
A Antiprogenic metals? 02:56PM

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Q Yes, sir.
A Well, it doesn't matter. I don't know.
Q Salts, same question?
A Yes, same answer.
Q And bacteria? 02:57PM
A Correct.
Q And I do take it you're not -- you don't have an understanding of which among potential sources would be the largest sources?
A I don't have an understanding because I 02:57PM haven't seen data that would allow me to get to such an understanding.
Q Would mass balance information allow you to have an understanding?
MR. GEORGE: Object to form. 02:57PM
A It may or may not. That's not what I was asked to look at.
Q Can we turn to Page 12 of your report, please?
A Okay.
Q The second paragraph where it starts there 02:58PM are, do you see that, sir?
A Yes.
Q Would you read that sentence for the Record, please?
A There are serious flaws in the logic that led 02:58PM

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to these conclusions. Olsen justifies his interpretation with a poorly reasoned apples-to-oranges comparison of loadings presented in abstract units of the PCA, log-transformed correlation coefficients to chemical data and units 02:59PM of concentration.
Q Could you explain for us what you mean by that statement?
A The loadings graphs that he shows -- in fact, we just looked at them. You had me turn to that 02:59PM page. It has been plotted -- do you recall the page we had that on? Oh, it's on the very next page.
Q Table 2-2, yeah. It's on Page 13.
A Yeah. The loadings, as your question indicated, is a function of the correlation 02:59PM coefficient between the principal component and these individual analytes. So the units there are units of a correlation coefficient, which vary from zero to one, so essentially unitness. The chemical compositions that he was comparing these bar graphs 02:59PM to was a table -- let me back up to the text that precedes that paragraph. So he's comparing to presume poultry waste impacted water, and I think by that, he was looking at his synthetic poultry leachate samples. I'll have to go back and see if 03:00PM

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there were others. So he's making a comparison of a loadings bar graph where the units are basically a correlation coefficient to a chemical composition in units of milligrams per litter, and in the case of bacteria, organisms per, I believe, it was hundreds 03:00PM milliliters or something like that. So that's what I mean by an apples-to-oranges comparison. They're different units.
Q Different units, but do you think it's fair, though, to compare your loadings, such as found on 03:01PM Figure 2-2, to what you know about the chemical composition of a source that you're investigating?
MR. GEORGE: Object to form.
A I think it's not an unreasonable place to start, but because the units are different -- the 03:01PM other thing when I look at these, and I alluded to this in an earlier response, I want to see -- you were asking about what the correlation coefficient or the height of the bar for total copper was for PC1, and eyeballing it, it looks on the order of .8 03:01PM or so. So it sounds like an impressive number, but then you go to the goodness-of-fit scatter plots that I showed and you see that copper has a very poor fit for this model. So when I look at that correlation coefficient or the loading number for 03:02PM

Q Do you know what that means?
A My recollection it stands for high flow sample.
MR. ELROD: Okay.
A Or high flow station. I don't recall if I ever saw a completely satisfactory explanation of what an HFS base flow sample is. Okay. Continuing on, the blue crosses are USGS base flow, which I believe would be stream flow samples. The red crosses would be USGS high flow. 03:33PM 03:34PM
Q Do you recall -- do you recall where these cattle synthetic leachates plotted on the PC1 SW3 analysis -- excuse me, on the SW3 analysis?
A Which leachate?
Q The cattle synthetic leachate. 03:34PM
A They were not in SW3. I think I -- if I didn't -- if I didn't, let me clarify. The leachate that I saw was a preliminary PCA that did not appear in Dr. Olsen's report, and I believe it was run sometime in mid April, so it was not SW3. 03:34PM
Q I thought you said you compared it with some stream samples in your previous testimony.
A That preliminary analysis was a PCA that included stream samples and the synthetic leachate samples. 03:35PM

Q I see. Thank you. Would you turn to Page A-30 of your report, sir? At the top paragraph do you see where it -- you mentioned this halfway down, for an interpretation of a PCA to be viable, it must be consistent with other lines of evidence? 03:36PM
A Yes.
Q Do you know whether or not Dr. Olsen considered other lines of evidence when he was doing his PCA evaluation?
A I don't know. These -- it did not appear that he evaluated lines of evidence that I point out following this paragraph. 03:36PM
Q Which was the spatial analysis?
A Yeah.
Q Did you review his report in Section 6 where he discussed the different lines of evidence he considered? 03:36PM
A With respect to the PCA?
Q Yes.
A Yes, I did. My recollection is that the primary line of evidence for validation of the PCA was the spatial analysis in terms of establishing a poultry threshold cutoff of 1.3. 03:36PM
Q I hand you what's been marked as Exhibit 8 and that's Section 6 to Dr. Olsen's report. 03:37PM

A Should I keep this open?
Q I don't think you need to keep it open. Do you recall reading Section 6.2?
A Not specifically.
Q Would you read the first paragraph under 6.2, please? 03:37PM
A The overall evaluation was conducted using multiple evaluations and investigations for multiple lines of evidence. The results of multiple evaluations and investigations were then used to determine overall conclusions concerning the hypotheses. This method of evaluation is called a weight of evidence approach. The evaluation conducted where the lines of evidence include the following. 03:37PM 03:37PM
Q Okay. So is that -- would it be fair to interpret that as Dr. Olsen's setting out the weight or lines of evidence he considered when he did his evaluation?
MR. GEORGE: Object to form. 03:38PM
A Let me read on and see what lines he cites.
Q Okay. Let's read the first one, the first --
A IRW geology and hydrogeology in relation to the fate and transport of potential sources of contamination. 03:38PM

Q Okay. Did you do a similar evaluation; did you do an evaluation of the IRW geology or hydrogeology in relation to fate and transport of --
MR. GEORGE: Object to the form.
Q -- potential sources of contamination when you did your evaluation? 03:38PM
MR. GEORGE: I'm sorry. Asked and answered.
A This goes back to the earlier questions. I was not asked to do this. There were other experts on the team that were doing it. 03:38PM
Q So you did not --
A My focus was on the bullet at the bottom, chemical and bacterial signatures, and relating that back to -- 03:38PM
Q But there are some other -- you've stated that it's important to look at other lines of evidence in doing an interpretation of PCA; correct?
A Uh-huh.
Q And you did not look at the geological and hydrogeological evidence when you did your PCA critique; correct? 03:38PM
MR. GEORGE: Object to form.
A I focused primarily on the lines of evidence within his PCA section that he said he used to 03:39PM

IN THE UNITED STATES DISTRICT COURT FOR THE
NORTHERN DISTRICT OF OKLAHOMA

W. A. DREW EDMONDSON, in his capacity as ATTORNEY GENERAL OF THE STATE OF OKLAHOMA and OKLAHOMA SECRETARY OF THE ENVIRONMENT C. MILES TOLBERT, in his capacity as the TRUSTEE FOR NATURAL RESOURCES FOR THE STATE OF OKLAHOMA,	)
Plaintiff,	)
vs.	) 4:05-CV-00329-TCK-SAJ
TYSON FOODS, INC., et al,	)
Defendants.	)

- -

VOLUME II OF THE VIDEOTAPED DEPOSITION OF GLENN JOHNSON, PhD, produced as a witness on behalf of the Plaintiff in the above styled and numbered cause, taken on the 25th day of February, 2009, in the City of Tulsa, County of Tulsa, State of Oklahoma, before me, Lisa A. Steinmeyer, a Certified Shorthand Reporter, duly certified under and by virtue of the laws of the State of Oklahoma.

generally increasing in copper, but there is another trend on higher numbered principal components than just the first two that is necessary to explain copper.
Q Did you do that evaluation? 01:18PM
A We discussed this yesterday. I looked at the scatter plots beyond two on the screen as I did my PCA. I don't recall when or if copper was well fit by what specific number. I do recall that for at least some of the bacteria data, the scatter plots 01:18PM were up around eight, nine or ten before they -- before they had a good fit.
Q Dr. Johnson, can't both your hypothesis of muddy water and Dr. Olsen's opinion that PC1 is associated with poultry waste both be true? 01:18PM
MR. GEORGE: Object to form.
A Only if you can dismiss all other sources of phosphorus that could be associated with particulate matter, and I don't believe he's done that, and I certainly can't dismiss them. 01:18PM
Q Did you try to determine what the other sources of phosphorus were in the watershed?
A I identified -- I know what the -- a list of potential sources. With this analysis, I was not able to do that and I was not asked to do this by my 01:19PM

client. I was asked to evaluate if this principal components analysis supports the conclusions that were in Dr. Olsen's report.
Q Let me ask you a question about the salty waters now. 01:19PM
A Okay.
Q Is it your opinion that Dr. Olsen's PC2 -- and we're talking about the SW3 runs here.
A Okay.
Q -- indicates nothing more than association 01:19PM with salty water?
A Again, an analogous answer to when we were saying am I saying that PC1 equals muddy water. I am saying that there's a trend of samples that increases from the bottom to the top along the left 01:20PM trend, and as you move up that trend, the samples increase in the concentration of sodium and chloride, which are analytes that prefer to be in the dissolved phase. They're preferentially in the dissolved phase. 01:20PM
Q And which analytes did you investigate for your trend analysis?
A Which analytes?
Q Yes.
A Well, again, this graph where you looked at 01:20PM

the goodness-of-fit, as far as any sample that I identified within that trend analysis for the left trend, I wanted to focus on samples that were -- at least that were somewhat well fit by the model. So on the scores plot, where I color coded the samples 01:20PM by the concentration of sodium plus potassium plus chloride plus sulfate, I looked at the scatter plot to determine the CD for potassium is .74. The closer you get to 1.0 the better fit.
Q Were there other dissolved solids that you did 01:21PM not consider in this analysis?
A Could I finish my response first?
Q I think I understand -- I thought you finished, but go ahead, please.
A All right. Well, I'll make it quick. 01:21PM Potassium is one of them. There were three others. Sulfate has a CD of .61. Sodium has a CD of .73, and what was our third one? Chloride as a CD of .75. So you asked what I did to evaluate. First of all, in picking those analytes, I wanted analytes 01:21PM that were well fit by the principal component analysis.
Q I asked you which analytes you selected.
A I thought you asked what I did to evaluate. This was step one. I apologize if you misunderstood 01:21PM

the question.
Q I wandered off a bit there. What do you mean by salty?
A Higher concentrations of dissolved phase sodium, chloride, potassium and sulfate. 01:22PM
Q So you didn't focus on total dissolved solids; you just selected four of the dissolved ions to evaluate?
A That's correct, and the explanation for that goes back to the goodness-of-fit analysis that I 01:22PM responded to the previous question with.
Q So it's your opinion that none of the other dissolved phase ions that were detected for the PCA analysis had a goodness-of-fit, so you ignored them?
A I didn't ignore them. It gave me reason to 01:22PM put more faith in how potassium and the sodium chloride and sulfate were being represented by model. I didn't ignore them at all. I evaluated them, and given the goodness-of-fit, those are the ones that are best fit by the model, so those are 01:22PM the ones I focused on.
Q What dissolved level would you characterize -- what level of TDS, even if we only looked at those four ions, which level of total TDS for those four ions would you consider as salty? 01:23PM

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Q Can you explain to me why the patterns on Figure 4-10 of your report and Figure 3-4 of your report appear to be different?
A I believe that that is because Figure 3-4 is zoomed in on just a section of the total SW3 scores plot as per Olsen's Figure 6.11-18C, and the Figure 4-10 is the entire range -- shows the entire range of all samples. So if you go to 6.11-18A of Olsen's report, I believe he shows how one of these insets is a subset of another. 01:30PM
Q So you would say a TDS of those four dissolved ions greater than 300 would be considered salty in your view?
MR. GEORGE: Object to form.
Q I'm trying to understand what you told me. 01:30PM
A That mischaracterizes my testimony.
Q I wasn't trying to do that, sir. I'm trying to understand your testimony.
A Then I disagree with what you just said. I said within the context of this dataset, those 01:30PM samples have the highest potassium plus sodium plus chloride plus sulfate. So they are the saltiest of this particular dataset. I doubt if those samples are as salty as seawater that you might get down in the Gulf of Mexico or the Atlantic Ocean. 01:31PM

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Q Do you think any of the ambient waters in the IRW are actually salty?
MR. GEORGE: Object to form.
A No, not as salty as a marine water sample, but I don't know. It's -- compared -- given in that 01:31PM context, I would imagine it would still be considered freshwater.
Q Did I understand your testimony, sir, yesterday that you believe there's an affinity for phosphorus, for aluminum and iron drives the system? 01:31PM
MR. GEORGE: Object to form.
A If you look at the samples along the bottom trend --
Q Can you just say if I even characterized that closely or correctly or not and then explain? 01:32PM
A There are elements of truth in that.
Q Okay. Now would you please explain?
A As you -- as you progress from left to right along the bottom trend of Figure 4-7, you are increasing in concentrations of total iron and total 01:32PM aluminum in the water sample and, in addition, samples along that trend are also increasing in total phosphorus.
Q Okay. That --
A So the total phosphorus -- total phosphorus is 01:32PM

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-- has -- a large part of the control in whatever total phosphorus you find, based on this, leads me to conclude it's related to adsorption to particulate matter, which is preferentially going to be iron and aluminum. 01:33PM
Q So it's -- so it's your -- your belief that the total phosphorus is being readily adsorbed by the aluminum and iron that's in the system?
A I think they preferentially adsorb the particulate matter, which will have high aluminum 01:33PM and iron. I also think there's probably -- there's probably -- depending on environmental conditions, there are probably times when the adsorbed phosphorus goes into solution. I wouldn't discount that or dismiss that as a possibility. 01:33PM
Q Then how would you account for that in your analysis that with increasing iron and aluminum, we're having a higher degree of adsorbed phosphorus?
MR. GEORGE: Object to form.
A I'm not sure how the statement I just made is 01:34PM inconsistent with that.
Q Well, I think you said that -- well, let me ask another question and we'll proceed through this.
A Okay.
Q Do you know the value of the partition 01:34PM

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coefficient for dissolved phosphorus in the IRW streams?
A No, I don't.
Q Would that have been important to demonstrating your analysis that's represented in 01:34PM Figure 4-7?
A It would not have changed the empirical observation. The total phosphorus, total iron and total aluminum increased in samples along that trend. 01:34PM
Q But you will agree, will you not, that the partition coefficient is a method to explain what you're demonstrating in Figure 4-7?
A If I wanted to make a predictive model instead of an -- instead of evaluate the results of an 01:34PM empirical model, I would use a partition coefficient, given certain other parameters, to predict if phosphorus would be in a dissolved phase versus associated with particulate phase.
Q Can you tell me what form phosphorus is found 01:35PM in the IRW rivers?
MR. GEORGE: Object to form.
A It has been -- there are analyses for both total phosphorus and dissolved -- and -- total phosphorus and dissolved phosphorus. 01:35PM

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Q What about for dissolved phosphorus; what form is it in?
A The two that are in SW3 are dissolved phosphorus and soluble reactive phosphorus. I think that's considered a soluble phosphorus as well. 01:35PM
Q You want to look that up?
A I'm sorry?
Q Do you want to look that up to be sure?
A No.
Q Okay. I'm going to hand you a blank page marked as Exhibit 23. 01:35PM
MR. GEORGE: Can I get my page?
MR. PAGE: Do you want one?
MR. GEORGE: I'll do without.
Q Would you please write the chemical formula for the form of phosphorus, dissolved phosphorus found in the IRW rivers? 01:36PM
A I'm not sure I know the chemical formula for that form of phosphorus. I don't know if it's associated with phosphate or whether it's three-phase. 01:36PM
Q Would you write both of them for us, please?
A I don't know the -- I don't know exactly what it is -- I don't know exactly what form it is associated with. 01:36PM

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Q Would you write the formula for phosphates, sir?
A (Witness complied).
Q Would you put the charge on the formula, please? 01:36PM
A I don't recall the valence of the phosphate cat -- anion.
Q Well, if it's dissolved, what would you expect it to be?
A I would expect it to be negative. I would expect it -- my recollection is perhaps minus 2 but it might be minus 3 or minus 4. I don't recall. 01:37PM
Q Okay. Could you just kind of put -- indicate what you think the range is for phosphate.
A I put minus 2 to minus 3, and that's my recollection. 01:37PM
Q Fair enough, and can you tell me what are the suspended particles that adsorb the P?
A The reference that I cite indicates aluminum, manganese, hydroxides. The degree to which they are also adsorbed by clay particles. I don't know. 01:37PM
Q Do you also believe it's iron oxides also given your analysis of the high association of --
A I said iron hydroxides. The degree to which they're oxides versus hydroxides, I'm not sure 01:38PM

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about.
Q Okay. Would they be negatively or positively charged?
A Well, the iron hydroxide, I think, would be electrically neutral because it would have both the cation and the anion. 01:38PM
Q What about aluminum?
A I would think the same thing.
Q Neutral?
A The aluminum plus the hydroxide, I don't know if there's an anionic complex that would still have aluminum or iron associated with it that would have a negative valence but -- 01:38PM
Q If these are suspended particulates, would you expect them to be negative or positively charged? 01:38PM
A I don't know.
Q Do you understand how adsorption is affected by the pH in the water of the IRW?
A I know that pH exerts a control over which the degree -- the degree to which these analytes would be adsorbed to particulates that would be in solution. Exactly what pH would cause a phosphate ion to go into solution or be adsorbed, I could not tell you. 01:39PM
Q Wouldn't that be important for you to know in 01:39PM

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order to validate your analysis that says that phosphorus is being adsorbed to these particulates?
A I have citations that said regardless of the pH, that they are very commonly adsorbed and with --
Q Is that your understanding of chemistry, that regardless of the pH of the water -- 01:39PM
A No. I'm saying -- you misunderstood my answer.
Q Okay. I'm sorry.
A pH is important if you want to know exactly at what point certain phosphate -- phosphate ions would be adsorbed rather than go into solution. My point was, looking empirically at the PCA scores plot where iron and aluminum increase along that trend, I'm sure that the pH in individual samples is important in determining whether it's going to be adsorbed into solution, but even without that knowledge, I can look at that graph and come to the conclusion that the total phosphorus increases in samples that also have higher concentrations of total iron and total aluminum. So in no way was I saying that pH is immaterial. 01:39PM 01:40PM
Q If pH was between 7.3 and 7.8, would the surface charge of the aluminum silicates, iron oxides and clays be all negatively charged? 01:40PM

MR. GEORGE: Object to form.
A I don't know.
Q Is it your understanding, sir, that negatively charged constituents or species repel each other?
A Yes. 01:41PM
Q So if both the phosphorus is negatively charged and the particulates are negatively charged, adsorption would not occur; is that correct?
A I have a feeling it's a bit more complicated than that. Are you telling me that -- I know that 01:41PM phosphorus will adsorb to clay particles. So I think there's probably a bit more to it than that characterization.
Q Well, if the phosphorus is in a dissolved phase and it's negatively charged and the 01:41PM particulates are also negatively charged, would you expect adsorption to occur?
MS. COLLINS: Object to form.
A I don't know. I've not approached this from a kinetics standpoint. There are others on our team 01:41PM that did. Again, I'm making the empirical observation on a principal scores plot that phosphorus in total phosphorus as reported by the lab is present in samples in higher concentrations as you get higher concentrations of total iron plus 01:42PM

total aluminum.
Q I think I'm quoting you, Dr. Johnson, in effect that other lines of evidence are always important to consider in order to validate your conclusions for PCA; is that not correct? 01:42PM
MR. GEORGE: Object to form.
A It is important to consider other lines of evidence. Are you representing to me that adsorption of phosphate does not occur onto iron and aluminum particles? 01:42PM
Q I think, Dr. Johnson, I'm representing to you that you should probably take a close look at this.
MR. GEORGE: So that means, no, he's not representing that to you.
Q Would you agree that there is a 01:43PM relationship -- let me say it this way: Would you agree that if both the particles and the phosphorus were negatively charged, there's less opportunity for adsorption?
A Yes. If that's true, I would expect, yes. 01:43PM
Q And that if one of the constituents was negative and the other one was positive, there would be an affinity for adsorption; is that correct?
A I think that's the -- that's accurate.
Q Did you review the data in the Access database 01:43PM

to evaluate relationships between dissolved and total phosphorus and the presence of TSS in the samples?
A I did not go back to the Access database at all. My starting point for this analyses were the 01:44PM Excel spreadsheets, the subdatabases, et cetera.
Q Did you make -- from any database did you make an evaluation of any type?
A The evaluation again was total versus -- would you read the question back? 01:45PM
(Whereupon, the court reporter read back the previous question at Page 452, Line 25 to Page 453, Line 3.)
A Well, I did bring TSS in from one of the Excel databases and plotted one of my graphs of the PC 01:45PM scores plot as a function -- with a symbol color being related to TSS, and those -- the TSS data that were available showed a similar pattern to the total iron plus total aluminum, so that gave me -- I'll get to your -- you asked me if I evaluated TSS. The 01:45PM answer is yes.
Q Well, in relationship to --
A If you'd like a shorter answer.
Q -- dissolved phosphorus and total phosphorus -- 01:45PM

A Total, yes.
Q -- concentrations?
A Total, yes.
Q You didn't look at the dissolved phase in the same sample? 01:45PM
A Well, I focused on total because the total phosphorus increases as total iron and total aluminum increases. I followed that observation up by plotting the PC scores over top with symbols related to total suspended solids. 01:46PM
Q Wouldn't it be important to understand the dissolved phosphorus component in order to measure the adsorption process that you are proposing for PC1?
MR. GEORGE: Object to form. 01:46PM
A If I was trying to kinetically model, that might be something I want to take into account. I was trying to establish that the empirical observation I was making on those scores plot was backed up by a set of data that wasn't even brought 01:46PM into the PCA, which was the total suspended solids data.
Q But if you were really trying to understand whether or not particulates or this iron and aluminum and clays, let's say, particulates were in 01:47PM

fact driving PC1, wouldn't it be important to also know whether or not they're having an impact on dissolved phase constituents in the same samples?
A I could look at that data to determine if it was consistent, but I would -- but I had literature and I had data that was not included in the PCA that were supportive of my conclusion that total phosphorus was a function of iron, aluminum and total suspended solids. You're asking are there other things that I could have looked at to see if that was also consistent with that, yes, there probably were, and this may well be one of them, but I did not do that part of it if that's what you're asking. 01:47PM
Q That was my question to you, sir. 01:47PM
A Okay.
Q Do you recall reviewing Appendix C of Dr. Olsen's report, and what I'm going to do is give you a copy of that and ask you to look at it.
A I did look at this appendix. 01:48PM
Q Would you turn to Page 2, please, sir?
A Uh-huh.
Q I don't know if I highlighted those. Yes, I did. Could you tell me what the levels -- first of all, tell me what sampling group this is on Page 2 01:48PM

of this exhibit.
A The title is Summary of Edge of Field Poultry Samples.
Q Okay. Do you recall that there were a summary of the edge of field poultry samples in Appendix C of Dr. Olsen's report? 01:48PM
A I recall it now that I look at it.
Q Okay.
MR. GEORGE: David, is it your representation that Exhibit 24 is an exact copy of what was exhibit -- I'm sorry, Appendix C to Dr. Olsen's report? 01:49PM
MR. PAGE: Yes.
MR. GEORGE: Okay. What threw me was the header at the top that says draft, do not produce. I don't recall seeing that on his report but maybe it was. 01:49PM
MR. PAGE: I don't recall either. My understanding, this is a copy of exactly what's in Appendix C of his report, Table 1. 01:49PM
Q Would you look at the total suspended and total dissolved solids, sir, under average?
A The highlighted section?
Q Yes, sir.
A Okay. I'm looking at it. 01:49PM

Q Okay. What is the total dissolved solids?
A 405.25.
Q And total suspended solids are what level?
A 267.984.
Q With regard to the total suspended solids, would you characterize those as being the -- I'm going to use it loosely -- but the muddy characterization? 01:49PM
A Yes, using that term loosely.
Q You would say --
A The higher total suspended solids implies higher turbidity, which would be characterized as muddier.
Q And would you be able to tell if this water -- would this water appear muddy or clear at 267.984 TSS? 01:50PM
A I don't know visually how that number would compare. I don't know how that number would compare to a visual observation of the sample.
Q You haven't taken samples before where you noticed the TSS and then observed whether the water appeared to be cloudy or clear? 01:50PM
A I probably have at some point in my career. I don't remember where the number 267 would have fallen in one those observations. 01:50PM

Q Okay. What about in your total dissolved solids; would that be within the area of salty in your analysis?
A Well, going back to -- okay. The top bin for total sodium plus potassium plus chloride plus sulfate -- well, that's -- there's more to total dissolved solids than just those four, but those on their own, the top bin of this graph is greater than 300 milligrams per liter. So this 405, to the extent that total dissolved solids can be taken -- that these four analytes can be taken as a proxy for total dissolved solid, this looks to be on the high end of the range. 01:51PM 01:52PM
Q Okay. Can I ask you, sir, to look at the total P using method 4500 and using total dissolved total P using 4500, and could you give me those two averages, please? 01:52PM
A You want me to average the two values?
Q Well, I think the average values are provided for you there. 01:52PM
A Oh, I see. Total dissolved P by 4500 PF is 4.8239. Total phosphorus by 4500 PF is 8.1395.
Q So what would be -- would the approximate dissolved phase of phosphorus be equal to about 59 percent of the total phosphorus in this particular 01:53PM

A I know that there were locations where I could see the bottom of the stream.
Q In that locations that you could not, was it because the water had kind of a greenish hue to it?
MR. GEORGE: Object to form. 02:23PM
A At Lake Tenkiller I remember I could see the bottom near the shore, and I couldn't see the bottom obviously when it got deeper. I don't know if that's because of a greenish hue or because the depth of the water. 02:23PM
Q Would you read for the Record the dissolved P method 4500 and the total phosphorus at the 4500?
A You mean the average concentrations for those two?
Q Yes, sir. I'm just going to focus on average 02:23PM concentration for this line of questions.
A Total dissolved P by 4500 PF, 0.2932. Total P by 4500 PF, 0.3117.
Q Would you estimate that the fraction of dissolved P would be greater than 90 percent in 02:23PM these samples?
A Around 90 looks to be a reasonable estimate.
Q Wouldn't that tend to negate your hypothesis that there's an affinity of phosphorus for total suspended solids in this system? 02:24PM

MR. GEORGE: Object to form.
A You previously -- this means that, if I'm reading this data correctly, the majority of the phosphorus in these samples is total dissolved.
Q Yes. 02:24PM
A And we have total suspended solids, which is on the low end. So I think this would be consistent with what I concluded in -- the samples to the left side of this graph tend to have lower total phosphate and -- I'm not sure I understand the 02:24PM question.
Q Well, doesn't this indicate, sir, that there isn't a lot of adsorption going on in small tributaries during high flow conditions?
MR. GEORGE: Object to form. 02:25PM
A We have both low total phosphate and we have relatively low total suspended solids. So for samples within that range of total suspended solids, I would agree with that.
Q And the sample type, which would be small 02:25PM tributary types high flow conditions?
A To the extent that these averages of over a hundred are representative of the dataset as a whole. I would imagine that this is not a uniform -- that these means are not narrowly calculated 02:25PM

around the 11.2712. I'd be curious to see a histogram that shows the full distribution of total suspended solids to see how representative that 11.27 is.
Q Is it your opinion, sir, that total dissolved 02:25PM solids -- excuse me -- total dissolved phosphorus in an Illinois River stream is low at .2932 parts per million?
A I don't know what number I would put on low versus not low. The .2 -- what number did you say? 02:26PM
Q I'm just reading the average here as .2932. I thought I heard you say that you characterized these phosphorus levels as low.
A Low in the context of the --
Q Well, it's low in the context we looked at for 02:26PM edge of field?
A Yes, yes.
Q And edge of field was 8.4.
A I forget what number is the -- is considered, and I don't know even know they use this term, an 02:26PM action level, so I'm not sure where the .2932 fits in that scale.
Q Do you know what the action level is for phosphorus in the IRW according to Oklahoma law?
MR. GEORGE: Object to form. 02:27PM

A No, I don't.
Q Would it surprise you to know it was .037?
MR. GEORGE: David, are you representing that's an action level?
MR. PAGE: Well, I'm just using his 02:27PM terminology.
MR. GEORGE: Well, are you -- you said did you know the action level is.
A And I prefaced action level saying I don't know if this is an accurate term. 02:27PM
Q Well, do you mean by like a phosphorus criteria?
A Yeah.
Q Okay. Yes, I'm representing that 0.37 is the phosphorus criteria for scenic rivers in the 02:27PM Illinois River watershed.
A Yes, that would be above that. The .2392 would be above that level.
Q Well above it; correct?
A Yes.
Q So in that context, it wouldn't be a low level of phosphorus, would it?
A You are correct.
Q Can we turn a couple more pages to Page 8, and does it not say at the top that these are the group 02:27PM